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# Admissible Heuristics

The Eight Puzzle consists of eight tiles, numbered 1 through 8, placed into a 3-by-3 board. Pieces are initially out of order, and they must be moved into standard 1-8 order by sliding one tile at a time into the empty square on the board. Let's assume the goal state is as shown here in G:

G:

| | | |
|---|---|---|
| | 1 | 2 |
| 3 | 4 | 5 |
| 6 | 7 | 8 |

J:

| | | |
|---|---|---|
| 4 | | 2 |
| 1 | 6 | 3 |
| 7 | 8 | 5 |

Consider the following heuristics. For each one (except perhaps the Sum of Euclidean distances), compute its value $h_i(J)$ for the state J given above. (When computing sums over the tiles, do not include the blank space as if it were a tile.)

Determine whether the heuristic is admissible. Explain why or why not. Finally, if it is admissible, determine what other heuristics it dominates.

| Heuristic | $h_i(J)$ | Admissible? | Why or why not ? | Dominates... |
|---|---|---|---|---|
| $h_0(n)$ = Zero | 0 | Y | Can never overestimate true distance to G. | none |
| $h_1(n)$ = Hamming (number of tiles out of place) | 7 | Y | Can never have more than 7 tiles out of space | $h_0$ $h_2$ $h_5$ |
| $h_2(n)$ = Manhattan distance of tile 1 alone. | 2 | Y | Can never overestimate true distance to G | $h_0$ |
| $h_3(n)$ = Sum of Manhattan distances for all 8 tiles. | 11 | Y | Never can get over 11 distance to G from J | $h_0$ $h_1$ $h_2$ $h_4$ $h_5$ $h_6$ |
| $h_4(n)$ = Sum of only the horizontal components of the Manhattan distance for all 8 tiles. | 7 | Y | Impossible to get over 7 distance | $h_0$, $h_2$ $h_5$ |
| $h_5(n)$ = Sum of only the vertical components of the Manhattan distance for all 8 tiles. | 4 | Y | Similar to $h_4(n)$ | $h_0$, $h_2$ |
| $h_6(n)$ = Sum of Euclidean distances for all 8 tiles. | 9.2 | Y | By calculation, 9.2 is the largest $h_6(n)$ value | $h_0$, $h_1$, $h_2$, $h_4$, $h_5$ |

Who were your groupmates for this activity? Write down their names and email addresses:

1. Justin Tran 2. Haokun Cai 3. Vijay 4. ______

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